Exploring Point-Slope Form of a Line

PRE-PLANNING

PRIOR KNOWLEDGE

- Know that the slope is calculated with two points on a given line and represents vertical change over horizontal change
- Know that any two points define a line
- Know that coordinate points have two components, x and y
- Know that the equation of a line has an x and a y variable
- Identify the equations of horizontal and vertical lines as having only an x *or* a y variable
- Know how to graph horizontal and vertical lines given their equations
- Know how to write the equation of horizontal and vertical lines given their graphs

LEARNING GOALS

- Given a graphed line, write the equation in point-slope form
- Graph a line given an equation in point-slope form

Common Core Standards	Common Core Practices
CCSS.Math.Content.HSA.REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line) CCSS.Math.Content.HSF.LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs	1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 5. Use appropriate tools strategically 7. Look for an make use of structure

MATERIALS

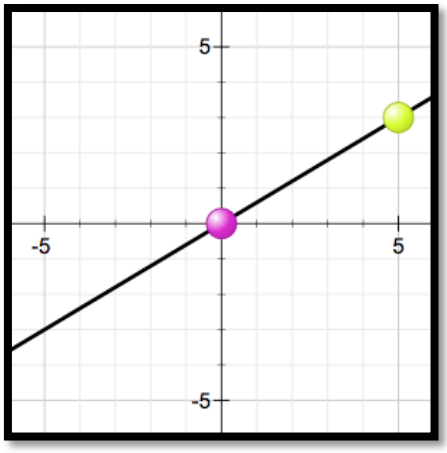
- PhET *Graphing Lines* simulation: https://phet.colorado.edu/sims/html/graphing-lines/latest/graphing-lines_en.html
- Computers/tablets for each student
- Notecards for each student
- "Exploring Point-Slope Form of a Line" Activity Sheet for each student (see below)

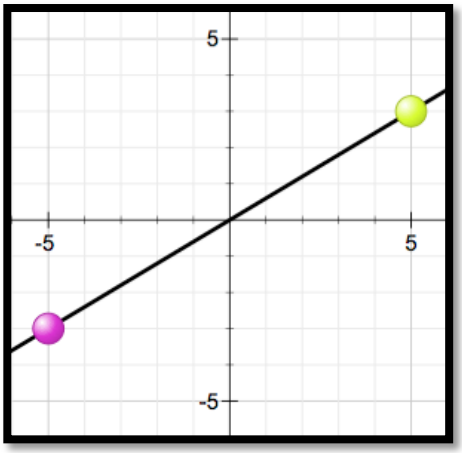
LESSON CYCLE

WARM-UP *5 minutes*

Activate prior knowledge by leading a discussion or having students journal about the following questions:

1. Find the slope of the two lines below.
2. What is different about their slopes?
3. What is similar?



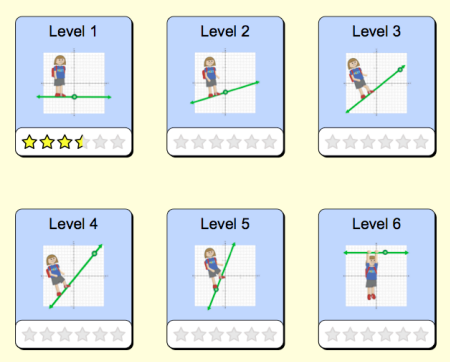


INTRO		*5 minutes*
Teacher will… • Instruct students to open up sim, find the Point-Slope screen, and explore for 5 minutes.		*Students will…* **Explore** the Point-Slope screen of the sim.
GUIDED EXPLORATION		*10 minutes*
Teacher will… • Circulate the room to be available for questions and ask probing/pushing questions, such as: 1. What is the relationship between the numbers in the equation and the graph? 2. Why do you think this [pink point] is colored this way? 3. How is point-slope form similar to slope-intercept form? What information do they both give us? 4. How is point-slope form different from slope-intercept form? 5. Think of a time when the point-slope form of a line is useful. • **#3-4 Pair-Share**: Prompt students to stop and compare their responses to #3-4. Note student responses and conversations. Facilitate a brief discussion about #3-4 with the sim and/or worksheet projected on the board and have a variety of students share aloud with the class.		*Students will…* Work on the entire activity sheet while interacting with the Point-Slope screen of the sim. **Discuss** #3-4 with their partner and share responses aloud with the class.
DISCUSSION		*15 minutes*
Teacher will… • Facilitate a class discussion to bridge an understanding across representations. Remind students to close their laptops or turn around so that the sim does not distract them from listening. Use an established teaching strategy such as popcorn discussion (one student answers, calls on the next student to talk), think-pair-share (pose question, allow time to think, turn and talk to partner), or group discussions (print out questions and have groups talk to each other and write down consensus to share aloud with class). Sample questions include: 1. Why is this equation named “point-slope”? 2. What do lines with the same *m* look like? 3. What do lines with the same (x_1, y_1) look like? 4. What does the equation of a vertical line look like? How does this relate to point-slope form? 5. What does the equation of a horizontal line look like? How does this relate to point-slope form?		*Students will…* Share responses to teacher questions.

ASSESSMENT *25 minutes*

If this is the third successive lesson for the simulation (or students have enough background information on slope-intercept form) direct students to the game screen of the sim.

Additionally, you can have students take screenshots of their completed levels and email them to you as evidence of their mastery:



Name: _____ **Class:** _____ **Date:** _____

Exploring Point-Slope Form of a Line

Learning Goals

- Write the equation of a line in point-slope form, given the graph
- Graph a line given an equation in point-slope form

1. **Explore** the point-slope screen for 5 minutes.
2. Manipulate parts of the **equation** *or* **graph** and describe the effects of each action.

Action	What was changed	How the equation is affected	How the graph is affected
Drag the pink point	☐ The equation ☑ The graph		
	☐ The equation ☐ The graph		
	☐ The equation ☐ The graph		
	☐ The equation ☐ The graph		
	☐ The equation ☐ The graph		

Amanda McGarry 9/12/14 1:47 PM

Comment [1]: As you circulate, consider asking a probing/pushing question if you find that students are getting stuck, such as:

1. What is the relationship between the numbers in the equation and the graph?
2. Why do you think this [pink point] is colored this way?
3. How is point-slope form similar to slope-intercept form? What information do they both give us?
4. How is point-slope form different from slope-intercept form?
5. Can you think of a time when the point-slope form of a line is useful?

3. Describe how $\boldsymbol{m}$ in the equation $y - y_1 = \boldsymbol{m}(x - x_1)$ relates to the graph.

4. Describe how $\boldsymbol{x_1}$ and $\boldsymbol{y_1}$ in the equation $y - \boldsymbol{y_1} = m(x - \boldsymbol{x_1})$ relate to the graph.

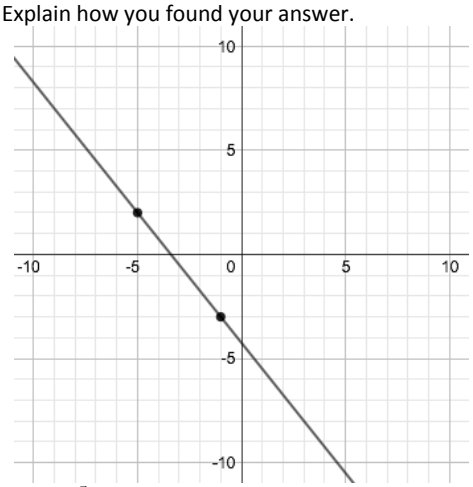
Amanda McGarry 9/12/14 1:47 PM

Comment [2]: This might be a useful point to stop and have students compare point-slope form with slope-intercept form from the previous day's lesson. Facilitate a brief pair-share where students compare their responses to #3-4 with their partners. Note different responses and have these students share aloud with the class.

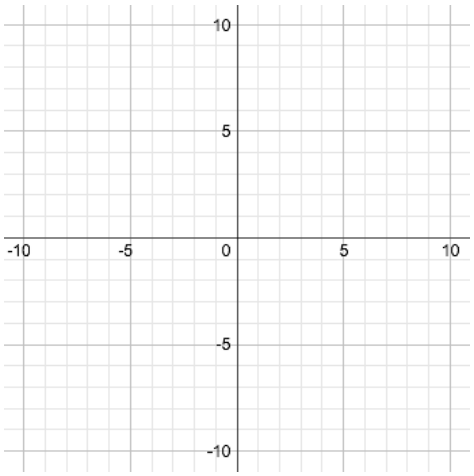
5. Complete the table below.

How can you…	Explain what you changed	What other changes did you notice?
Make a line steeper?		
Transform a line without changing the slope?		

6. Write the equation (in point-slope form) of the line below. Explain how you found your answer.



7. Describe how you would graph a line with the equation $(y - 3) = \frac{5}{2}(x + 4)$ and graph it on the grid provided.



Amanda McGarry 9/12/14 1:47 PM
Comment [3]: Note interesting strategies that students use to answer #7. Do they use the sim to help? Where do they start? Are students accurate?

Make note of student responses so you can be sure to call on a variety of students later.

Amanda McGarry 9/12/14 1:48 PM
Comment [4]: If students have finished the activity sheet and discussions, direct them to the game screen of the sim.